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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/605,227	09/16/2003	Kangguo Cheng	FIS920030221US1	2226

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INTERNATIONAL BUSINESS MACHINES CORPORATION
DEPT. 18G
BLDG. 300-482
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HOPEWELL JUNCTION, NY 12533

EXAMINER

ROSE, KIESHA L

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 07/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/605,227	Applicant(s) CHENG ET AL.	
	Examiner Kiesha L. Rose	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) ____ is/are pending in the application.
 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 13-20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 September 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>9/16/03</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

This Office Action is in response to the Election filed 30 April 2004.

Election/Restrictions

Claims 1-12 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected method of making a semiconductor device, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 30 April 2004.

Applicant's election without traverse of claims 13-20 in the reply filed on 30 April 2004 is acknowledged.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description:

Fig. 7, #'s 150/152

Corrected drawing sheets, or amendment to the specification to add the reference character(s) in the description, are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct

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any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "182" has been used to designate both spacing and interlevel dielectric. Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Structure of Vertical Strained Silicon Devices

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 13,15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agahi et al. (U.S. Patent 6,335,239) in view of Hummler et al. (U.S. Patent 6,586,300).

Agahi discloses a DRAM (Fig. 2b) that contains a semiconductor wafer (203), a wafer having a trench etched through, an isolating collar (210) formed within the trench, a lower contact (218) for the vertical transistor formed above the collar, a vertical body layer of strained silicon (P-epi) formed on an exposed vertical surface within the trench extending upward and under a overhang of a pad dielectric (242), a gate dielectric (gate ox), formed on an exposed vertical surface of the silicon body layer within the trench, thereby isolating the body layer from the trench interior, a gate electrode (N+ Poly) formed within the trench an separated from the body layer of silicon by the gate dielectric layer, an upper electrode (220) formed in contact with the body layer of silicon thereby establishing a path for conducting carriers from the lower contact to the upper contact through the vertical body layer, the gate electrode extending up to a wafer surface thereby leaving a central gate electrode ((N+ Poly (under WL conductor)) of width less than original trench width and having at least one aperture adjacent thereto that extends outward to the original trench width and down to make contact with the upper electrode and dielectric (OX) filling aperture adjacent to the central gate electrode to isolate central gate electrode, the central gate electrode capped by a gate contact cap (WL Conductor) and bracketed by gate contact sidewalls (Oxide) and an aperture (282) for a drain contact (232) formed adjacent to one of the gate contact sidewalls and being located transversely with respect to central gate electrode to make contact with said vertical body layer and with said drain, a capacitor (204/206) formed within a lower

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portion of the trench. Agahi discloses all the limitations except for a SiGe alloy on substrate. Whereas Hummler discloses a DRAM (Fig. 10) that contains a SiGe wafer above a bulk substrate, a trench etched through the SiGe layer into substrate, an isolating collar (120) formed within the trench, a lower contact (122) for the vertical transistor formed above the isolating collar and being in contact with a portion of the SiGe layer, a gate dielectric layer (154) formed on the exposed vertical surface of the trench, a gate electrode (156), a capacitor (124) formed within the lower portion of the trench, an isolating layer (131) formed within the trench overlapping vertically the lower contact thereby separating capacitor from the upper portion of the trench. The wafer was a SiGe layer to act as a workplace for a DRAM device to be formed. (Column 4, lines 24-35) Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Agahi by incorporating a SiGe wafer layer to act as a workplace for a DRAM device as taught by Hummler.

Claims 14 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agahi and Hummler as applied to claims 13 and 19 above, and further in view of Imai et al. (U.S. Patent 5,847,419).

Agahi and Hummler disclose all the limitations except for a SiGe buffer layer formed between the substrate and SiGe layer. Whereas Imai discloses a semiconductor device (Fig. 3d) that contains a substrate (11), a SiGe buffer layer (12) and a SiGe layer (15) formed thereon. The buffer layer is SiGe between the substrate and other SiGe layer to form tensile strain and improve higher speed. (Column 4, lines 48-65) Therefore it would have been obvious to one having ordinary skill in the art at the

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time the invention was made to modify the devices of Agahi and Hummler by incorporating the SiGe buffer layer between the substrate and other SiGe layer to form tensile strain and improve higher speed as taught by Imai.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kiesha L. Rose whose telephone number is 571-272-1844. The examiner can normally be reached on M-F 8:30-6:00 off 2nd Mondays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


KLR


Michael Trinh
Primary Examiner
Act SPE